

Attny Docket No. 99P03591US

**METHOD AND DEVICE FOR TREATING THE SURFACE OF A PART**

Cross-Reference to Related Applications

This application is the US national stage of  
5 International Application No. PCT/EP00/08049, filed  
August 17, 2000, which was not published in English  
under PCT Article 21(2) and which claims priority to  
EP/99117220, filed September 1, 1999.

10 Field of the Invention

The invention relates to a method for the surface  
treatment of a component having a curved component  
surface, in which material is removed from the  
component surface by means of a particle jet which is  
15 generated from a particle source. The invention also  
relates to a device for the surface treatment of a  
component having a curved component surface.

Background of the Invention

20 The book "Plasma Spraying of Metallic and Ceramic  
Materials" by D. Matejka and B. Benko, John Wiley &  
Sons, Chichester, U.K., 1989, has disclosed the method  
of plasma spraying together with applications, for  
example on components of an internal combustion engine  
25 of a motor vehicle. The section 6.1 "Preliminary  
preparation of surface prior to spraying" describes  
various methods which are used to prepare a component  
which is to be coated. This section describes a method  
for cleaning the surface of the product by means of a  
30 jet of abrasive particles prior to the actual coating  
operation. The abrasive particles are entrained in a  
compressed-air stream and preferably impinge on the  
surface to be treated at right angles. The blasting  
treatment with the abrasive particles can be carried  
35 out in a chamber or using a suction device, so that  
substantially the entire quantity of abrasive particles  
is recovered and is available for a further blasting  
treatment. Abrasive particles can in this case be  
produced from cast iron, steel from synthetic corundum

(aluminum oxide  $\text{Al}_2\text{O}_3$ ), silicon carbide or silicate sand (quartz sand). The abrasive particles may have a diameter of between 350  $\mu\text{m}$  and 1400  $\mu\text{m}$ . The blasting is preferably carried out by means of what is referred to as grit blasting, in which the abrasive particles are corundum particles with a diameter of between 200  $\mu\text{m}$  and 800  $\mu\text{m}$ . These particles are used to prepare a surface having a coating with a layer thickness of up to 200  $\mu\text{m}$ , which coating is applied to the prepared surface in a coating process. Particle diameters of up to 1400  $\mu\text{m}$  are used for coatings with a greater layer thickness. The compressed air in which the abrasive particles are entrained is preferably at a pressure of up to 0.35 MPa when using corundum.

US patent 4,321,310 has described a method for producing a coating on a gas turbine component which is a turbine blade or vane. The turbine blade or vane has a base body made from a base material. The base material used is a cobalt-base or nickel-base alloy, such as for example IN 100, MAR M200, MAR M509 or WI 52. A bonding layer of the type MCrAlY is applied to this base material. In this context, M denotes, for example, a combination of the metals nickel and cobalt. Cr represents chromium, Al represents aluminum and Y represents yttrium. A ceramic layer of zirconium oxide, which is grown on in columnar form, the columns being oriented substantially perpendicular to the surface of the base body, is applied to this bonding layer. Prior to the application of the zirconium oxide layer used as thermal barrier coating to the bonding layer, the bonding layer is polished until a surface roughness of approximately 1  $\mu\text{m}$  is established.

US patent 5,683,825 likewise reveals a method for applying a thermal barrier coating to a component of a gas turbine. An NiCrAlY bonding layer is applied to a base body by low-pressure plasma spraying. The surface of the bonding layer is polished, so that it has a

- surface roughness of approximately 2  $\mu\text{m}$ . A ceramic thermal barrier coating comprising yttrium-stabilized zirconia is applied to the bonding layer which has been polished in this way by means of a physical vapor deposition (PVD) method. The thermal barrier coating is in this case preferably applied using the electron beam PVD method. The thermal barrier coating may also be applied by means of plasma spraying. US patent 5,498,484 likewise describes the application of a thermal barrier coating to a bonding layer of a component of a gas turbine. The mean surface roughness of the bonding layer is given as being at least over 10  $\mu\text{m}$ .
- 15 US patent 5,645,893 relates to a coated component having a base body made from a superalloy and having a bonding layer and a thermal barrier coating. The bonding layer includes a platinum aluminide and an adjoining thin oxide layer. The thin oxide layer includes aluminum oxide. This oxide layer is adjoined by the thermal barrier coating, which is applied by means of the electron beam PVD method. In this case, yttrium-stabilized zirconia is applied to the bonding layer. Prior to the application of the bonding layer, the surface of the base body is cleaned by means of a grit blasting method. Alumina grit is used for the material-removing preparation of the base body.
- WO 97/047781 A1 has disclosed a gas turbine component, for example a gas turbine blade or vane or a heat shield element of a combustion chamber. The base material of the gas turbine component is a nickel-base or cobalt-base superalloy. A bond coat comprising a nitride is applied to the base material. The bond coat is adjoined by a ceramic thermal barrier coating. The surface of the bond coat has a mean surface roughness of over 6  $\mu\text{m}$ , in particular between 9  $\mu\text{m}$  and 14  $\mu\text{m}$ .

WO 99/23272 has described a method for producing a protective coating on a base body which is designed to be exposed to hot gases in order to protect against oxidation and/or corrosion. The protective layer is compressed by a hot isostatic pressing method, during which it remains unsealed. In the process, the protective layer remains chemically substantially unchanged. During the hot isostatic pressing, a pressure exerted by a compressed gas is used to compress the porous protective layer for a time of between approximately 0.1 and 3 hours at temperatures of from approximately 800°C to 1200°C. Unlike the documents mentioned above, the hot isostatic pressing is a surface treatment which does not involve removal of material.

#### Summary of the Invention

It is an object of the invention to describe a method for the surface treatment of a component. It is a further object of the invention to provide a device for the surface treatment of a component.

According to the invention, the object relating to a method is achieved by a method for the surface treatment of a component (having a curved component surface, in which material is removed from the component surface along a contour line on the component surface by means of a particle jet which is generated from a particle source and is characterized by the jet parameters blasting distance, blasting intensity, blasting angle and blasting time, in which method at least one of the jet parameters is deliberately matched to the contour line in such a way that a homogeneous surface roughness is established along the contour line.

The invention is based on the consideration that irregularities in the component surface and uneven removal of material during the material-removing

preparation of component surfaces have an adverse effect on the quality of the component surface and therefore on its usability. In methods for the surface treatment of components which have been disclosed

5 hitherto, in particular in the case of material-removing preparation, uniform surface preparation of the component is not ensured over the entire component surface or over relatively large adjoining regions of the component surface. Particularly in the case of

10 components with a complex component geometry, in particular with a curved component surface, the curvature leads to a local variation in the jet parameters. By way of example, a complex component geometry leads to a variation in the jet distance, i.e.

15 the distance from the particle source to the component surface which is to be treated, which leads, for example, to different surface roughnesses in different areas of the component surface. This is true in particular of those areas of the component surface

20 which have a different curvature. Furthermore, those areas of the component surface which have a curvature which varies greatly on a local basis and those areas which are difficult for the particle jet to gain access to using conventional methods are subject to

25 irregularities (inhomogeneity) in the surface structure. Furthermore, only limited reproducibility can be ensured in the surface treatment of a multiplicity of components.

30 The method has for the first time taken account of characteristic jet parameters of the particle jet in relation to the local component geometry. In this context, the term blasting distance refers to the distance from the particle source to the point of

35 impingement of the particle jet on the component surface. The blasting angle is defined in a local, component-related system of coordinates. In this reference system, the blasting angle is the angle between the blasting direction of the particle jet and

the local normal to the component surface at the point of impingement of the particle jet on the component surface. The blasting intensity is understood as meaning the number of particles emitted from the particle force per second and solid angle, i.e. the blasting intensity is given as a particle flow rate. The number of particles which impinge each second on a local surface region on the component surface therefore results in a simple way from the blasting distance, the size of the surface region and the blasting angle. The blasting time is understood as meaning the residence time of the particle jet on a selected section of the contour line. The residence of the particle jet and therefore the number of particles which locally impinge on the component surface can be varied by means of the speed at which the particle jet is guided along the contour line. The method allows the amount of material removed from the component surface to be deliberately matched to the geometry of the component. In this way, it is possible to produce a predeterminable homogeneous surface roughness along the contour line. As a result of a plurality of cohesive contour lines being tracked in succession, it is possible for large areas of the component surface to be treated and homogenized in terms of their roughness. In particular, the entire component surface can be subjected to a surface treatment of this type.

For an efficient application of the method, the method will preferably be operated continuously. For this purpose, the particle jet is guided along the contour line as a continuous function of time. As an alternative, the removal of material from the component surface along the contour line could also be carried out discontinuously, with the method being temporarily interrupted. With the method, it is possible to deliberately set the surface roughness characteristic variables, for example maximum profile height, maximum profile depth, roughness average. The roughness average, that is to say the arithmetic mean of the

absolute values of the profile deviations within a reference distance (e.g. a partial section of a contour line) is in this case preferably used to compare surfaces of identical or similar character.

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It is also possible for various partial regions of the component surface, which may, for example, be differently curved or oriented, to be deliberately produced with different predeterminable surface roughnesses. Each partial region in this case has a homogeneous surface roughness. Where appropriate and intended, it would also be possible for the surface roughness to be set according to a predeterminable, optionally non-constant function along a contour line.

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By means of the blasting matched to the contour line using the particle jet, the component surface is smoothed in order to set a predetermined surface roughness in a predetermined region of the component surface. Furthermore, the blasting with the particle jet can be used for surface cleaning of the component surface, leading to activation of the component surface. In this way, the component surface is prepared for other methods - for example methods - which follow the surface treatment.

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It is preferable for the jet parameters to be adapted automatically. This ensures good reproducibility. Furthermore, manual interventions in the method are no longer required.

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It is preferable for the particle source and the component to be moved relative to one another. This involves relative translational movements, relative rotational movements and or combinations of translational movements and rotational movements. This relative movement of particle source and component makes it possible to guide the particle jet to a desired location and along a contour line on the component surface. The speed at which the relative movements are carried out allows the blasting

time to be varied. Particularly in the case of components with a complex component geometry, for example with a curved component surface, the relative movements are used to influence jet parameters, such as for example blasting angle and blasting distance. A wide range of operating modes with regard to the relative movements of component and particle source are possible. A few preferred configurations in the method are described below:

- 10 In a preferred configuration of the method, the particle source is moved relative to the component in such a way that the blasting distance is constant. As a result, given a constant blasting intensity of the particle source, the number of particles which impinge
- 15 each second on a surface element of the component surface which is arranged at right angles at a constant blasting distance, is a constant value. Furthermore, it is preferable for the particle source to be moved relative to the component in such a way that the
- 20 blasting angle is constant. If an operating mode in which both the blasting distance and the blasting angle are constant is selected, removal of material which is particularly is well matched to the geometry of the component is ensured, and in particular homogeneous
- 25 surface treatment of the component is possible as a result.

- The relative movements are carried out in such a way that, in a preferred method configuration, the particle
- 30 source is moved in a plurality of axes with respect to the component which is simultaneously stationary. In this context, the term in a plurality of axes means that the particle source is moved along at least two Cartesian coordinate axes. The combination of movements
- 35 in a first axis and in a second axis which is perpendicular thereto also allows the particle source to rotate about a rotation axis, for example about an axis which runs through the component (cf. Figure axis). Furthermore, it is preferable for the particle

source to be moved in a plurality of axes with respect to the component which is simultaneously rotating. Furthermore, it is preferable for the particle source to be moved in a plurality of axes with respect to the component which is simultaneously being moved in a plurality of axes.

Preferably, the component is moved in a plurality of axes with respect to the particle source which is simultaneously stationary. The wide range of different method configurations with regard to the relative movements provides a high level of flexibility. The combination of the various movement modes allows very complex component geometries to be subjected to a surface treatment in the method.

The component preferably has a base body with a base material, the base body having the component surface which, for a first coating to be applied to the base body, is treated with a first coating material. The blasting with a stream of particles leads to surface cleaning of the base body. This surface cleaning results in activation of the surface. As a result, particularly good bonding of a first coating to the base body is possible in a coating method. The method can therefore be used as a subprocess of a method for producing a layer on a component. The method allows high-quality preparation of the component surface prior to a coating operation. This has a very advantageous effect on the coating which is to be applied to the base body, primarily its adhesion and layer quality. The base body is produced, for example, from a metallic material. In this case, in the case of high-temperature applications, alloys which are able to withstand high temperatures, for example nickel, cobalt or chromium superalloys, are used as material for the base body.

In this case, it is preferable for an alloy or an intermetallic compound to be used as the first coating

material in the coating process. The first coating material used is preferably an alloy which forms a bonding layer, such as for example an alloy of the type MCrAlX. In this context, M represents a metal, in particular one or more elements selected from the group consisting of nickel, cobalt and iron. Cr represents chromium and Al represents aluminum. X represents one or more elements selected from the group consisting of yttrium, rhenium and the rare earths, such as for example hafnium. Alloys of this type are provided in particular in high-temperature applications.

The first coating preferably also has the component surface which, for a second coating to be applied to the component, is treated with a second layer material.

In a preferred configuration, the component has a base body with a base material, a first coating comprising a first coating material being applied to the base body, and the coated component, for a second coating to be applied to the component, being treated with a second coating material. The method is advantageously suitable not only for treating the surface of a base body, but also for the treatment and preparation of a layer which has been applied to the base body prior to the application of a further layer to the first layer. The method can therefore be integrated in a process for producing a layer system on a component. This allows very high-quality layer systems, which in particular have sufficient long-term stability and have a complex geometry of the base body, to be produced significantly more successfully.

In the coating process, it is preferable for a ceramic to be used as the second coating material. Examples of suitable ceramic materials are those which include zirconium oxide ( $ZrO_2$ ), which has been partially or completely stabilized by yttrium oxide, cerium oxide or another oxide. A second coating of this type, which

includes a ceramic, is, for example, a thermal barrier coating and as such has a layer thickness of approximately  $> 50 \mu\text{m}$ , in particular approximately  $> 200 \mu\text{m}$ . A thermal barrier coating may also include other metal-ceramic oxides, in particular including metal-ceramic mixed oxide systems, for example perovskites (e.g. lanthanum aluminate), pyrochlores (e.g. lanthanum hafnate) or spinels such as for example the classic magnesium aluminate spinel  $\text{MgAl}_2\text{O}_4$ .

A layer system on a metallic base body which has a bonding layer as the first coating and a thermal barrier coating, which adjoins the bonding layer, as second coating, is used in particular for high-temperature applications. In a preferred configuration of the method, the component is designed for a hot gas to flow around it. Furthermore, it is preferable for the component used to be a turbine rotor blade, a turbine guide vane or a heat shield element of a combustion chamber. Components of thermal machines, such as for example a gas turbine, an internal combustion engine, a furnace or the like, have to be designed to be exposed to a hot aggressive medium, in particular a hot gas. The temperatures to which a component is exposed during normal use may in this case be well over  $1000^\circ\text{C}$ .

The particle jet preferably includes abrasive particles which are entrained in a pressurized carrier medium, in particular compressed air. The abrasive particles preferably impinge on the component surface at a blasting angle of approximately  $20^\circ$  to  $90^\circ\text{C}$ , in particular of approximately  $50^\circ$  to  $90^\circ$ . The diameter of the abrasive particles, the blasting angle and the pressure of the pressurized carrier medium depend on the material of the abrasive particles, the material of the component surface on which they impinge, and on the effect which is to be achieved, in particular with regard to surface cleaning or removal of material in

- order to establish a desired surface roughness. If a large amount of material is to be removed, the angle at which the abrasive particles impinge on the surface is approximately between 50° and 90°, in particular approximately 60°. For cleaning and activation of the component surface, the angle is in a range between 20° and 60°. The abrasive particles which are entrained in the carrier medium may be provided in the form of a powder or, if relatively large particles are present (globular particles), can be broken up by a milling process, in order to produce sharp-edged abrasive particles which then have an increased abrasive action on the component surface.
- According to the invention, the object relating to a device for the surface treatment of a component is achieved by a blasting installation for the automated surface treatment of a component having a curved component surface, which installation has a particle source for generating a particle jet and a component holder for holding the component, the particle source and the component being movable relative to one another in such a way that, to produce a homogeneous component surface in a blasting process using the particle jet, the blasting distance and/or the blasting angle adopts a predetermined, in particular constant value along a contour line on the component surface.

#### Brief Description of the Drawings

- The method and the device are explained in more detail with reference to the exemplary embodiments in the drawing, in which, in some cases not to scale and diagrammatically:
- FIG 1 to FIG 3 show part of a base body of a component with a free, in particular curved component surface,

- FIG 4 shows part of a component in which a first coating has been applied to a base body,
- 5 FIG 5 shows part of a component in which a first coating and a second coating have been applied to a base body,
- FIG 6 shows a perspective view of the turbine blade or vane,
- 10 FIG 7 shows a heat shield element of a combustion chamber, in a perspective illustration,
- 15 FIG 8 shows a blasting installation for surface treatment, with a component arranged in the blasting installation.
- 20 Identical reference symbols have the same meaning throughout the figures.

Detailed Description of the Preferred Embodiment

- Figure 1 shows part of a base body 11 of a component 1
- 25 (cf. for example Figure 6 or 7) which is not shown in more detail and has a base material 13, in particular a nickel or cobalt superalloy. The base body 11 has a component surface 3. For surface treatment of the component surface 3, for example for pretreatment prior
- 30 to the application of a coating to the component surface 3, the component surface 3 is blasted with abrasive particles 27 from a particle jet 7, which are entrained in a pressurized carrier medium 29, in particular compressed air 29. A particle source 5 is
- 35 provided for generating a particle jet of this type comprising the carrier medium 29 and the abrasive particles 27 entrained therein. The treatment of the component surface 3 with abrasive particles 27 is used to smooth the component surface 3, producing a

predetermined surface roughness. Furthermore, the blasting of the component surface is used to clean and activate the component surface. For this purpose, the abrasive particles 27 impinge on the component surface 3 at an angle  $\alpha$ . The abrasive particles 27 in this case preferably consist of the base material 13 or of a material which is the same as a coating material which is to be applied to the base body 11 following the blasting with the abrasive particles 27. To achieve a desired, in particular homogeneous surface roughness, the particle source 5 can move relative to the component 1. The particle source 5 can execute movements along a horizontal axis 31 and along a vertical axis 33 relative to the component 1. Furthermore, the particle source 5 can rotate about an axis of rotation 35. The axis of rotation 35 extends perpendicular to a plane which is defined by the vertical axis 33 and the horizontal axis 31. Consequently, the particle jet 7 which is emitted from the particle source 5 can be guided along a contour line 9 on the component surface 3. In particular, different regions on the component surface 3 along the contour line 9 can be subjected to material-removing processing by the abrasive particles 27. To achieve a homogeneous surface roughness, the jet parameters are in the process deliberately matched to the contour line. This is illustrated in Figures 1 to 3, which show a chronological sequence of the surface treatment along the contour line 9. In this case, the particle source 5 is moved relative to the component 1 in such a way that the blasting distance  $d$  is constant. At the same time, the particle source 5 is moved relative to the component 1 in such a way that the blasting angle  $\alpha$  is constant. As a result, different regions of the component surface 3 along the contour line 9 can be treated in the same way. While Figure 1 shows a convexly curved region of the contour line 9 being treated by the particle jet 7, in Figure 2 the particle jet 7 is acting on a concavely curved region of the

contour line 9. In Figure 3, the material-removing processing of the component surface 3 takes place in a region of the contour line 9 which is approximately planar. The particle source 5 is controlled automatically. In this case, by way of example, the precise component geometry, in particular the component surface, can be recorded by a measurement system (not shown), and this actual data can be compared with desired data. These data sets can be used as input data for a control system (not shown) which controls the particle source 5 in terms of the jet parameters relative to the component 1. The result is automatic surface treatment of the component 1.

Figure 4 shows the base body 11 from Figures 1 to 3, a first coating 15 comprising a first coating material 17 having been applied to the base body 11. The first coating is preferably a bonding layer and has been applied by means of a physical vapor deposition method, for example electron beam physical vapor deposition (EB-PVD) or a plasma spraying method. The first coating 15 has a first coating material 17 which, particularly when coating a gas turbine component, is an alloy of the type MCrAlX or an aluminide. The first coating 15 has now formed a component surface 3 of the component 1 on that side of the coating 15 which is remote from the base body 11. This component surface 3 is now being prepared for the application of a second coating 19. For this purpose, the surface 3 is blasted with abrasive particles 27 from the particle source 5. The abrasive particles 27 are entrained in a pressurized carrier medium 29 in a particle jet 7. Compressed air is preferably used as the carrier medium 29. The abrasive particles 27 impinge on the component surface 3 at a blasting angle  $\alpha$ , which is identical to or different than the blasting angle  $\alpha$  used in the blasting of the base body 11 shown in Figures 1 to 3. The specific choice of the blasting angle  $\alpha$  and of the blasting distance  $d$  and the pressure applied to the

carrier medium 29 depends on the type of material used for the abrasive particles 27, the nature of the first coating material 17 and, for example, also on a surface roughness or cleaning of the component surface 3 which is to be achieved. During the material-removing surface treatment of the layer 15, the particle jet 7 is guided along a contour line 9 in such a manner that a surface roughness which is to be achieved and is generally homogeneous is established along the contour line. The method in particular allows contour lines 9 which are present on curved component surfaces 3 to be processed with high quality and reproducibility. It is advantageous that the first coating 15 has already been produced with a high bonding capacity and a high creep strength on the base body 11 using the method.

Figure 5 shows part of the product 1, in which, in addition to the first coating 15, a second coating 19 comprising a second coating material 21 is also been applied to the base body 11. An oxide layer 69 as interlayer 69 is arranged between the second coating 19, which in the case of a component of a gas turbine is preferably a thermal barrier coating comprising a metal oxide or a mixed metal oxide system, for example partially or fully stabilized zirconium oxide. This oxide layer 35 includes aluminum oxide and/or chromium oxide and may have been formed through thermal oxidation of the first coating 15 (thermally grown oxide, TGO) or has been applied to the first coating 15 in an intermediate step. Therefore, the method can be used for layer systems on components 1 with a complex component geometry with a complex component geometry, in particular with a curved component surface 3. As a result, the quality of a layer system is considerably improved.

Figure 6 shows a perspective view of a component 1, in this case a turbine rotor blade 23, which has a blade region 37 which has been coated with a coating 19,

namely a thermal barrier coating. During operation of the turbine blade 23, for example in a gas turbine (not shown), a hot aggressive medium M, in particular a hot gas M, which results from combustion of a fuel, flows around the blade region 37. The blade region 37 is adjoined on one side by a securing region 39, in which the turbine rotor blade 23 of the gas turbine is secured, and on the other side by a cover plate 41 which is used to seal the turbine rotor blade 23 with respect to a further component (not shown) of the gas turbine. The turbine rotor blade 23 has a component surface 3 which has a complex component geometry with regions with a greatly differing curvature.

Figure 7 shows a perspective illustration of a component 1, a heat shield element 25 of a combustion chamber (not shown) of a gas turbine. The heat shield element 25 has a covering element 43 with a connection hole 45 arranged centrally therein. The connection hole 45 allows the covering element 43 to be guided over a connection element (not shown) and allows the heat shield element 25 to be secured to a wall (not shown) of the combustion chamber. A combustion chamber of a gas turbine is lined with a multiplicity of heat shield elements 25 of this type. Like the turbine rotor blade 23 shown in Figure 6, the heat shield element 25 has a complex, in particular curved component surface 3. While the heat shield element 25 is in use, its thermal barrier coating 19 is exposed to a hot aggressive medium M, in particular a hot gas M.

Figure 8 shows a diagrammatic illustration, not to scale, of a blasting installation 47 for the automated surface treatment of a component 1. The blasting installation 47 has a blasting chamber 65 in which a component holder 49 is arranged. A component 1 is held by the component holder 49. The component 1 has a curved component surface 3. A first particle source 5A and a second particle source 5B are arranged in the

blasting chamber 65. The particle sources 5A, 5B are arranged in such a way that, for a blasting process, they reach opposite regions of the component surface 3. To generate a particle jet 7A, 7B which includes

5 abrasive particles 27 and a carrier medium 29, an abrasive particle reservoir 57 and a carrier medium reservoir 53 are provided in the blasting installation 47. The carrier medium reservoir 53 supplies the particle source 5A, 5B via a first supply line 51 for

10 carrier medium 29. To supply the particle source 5A, 5B with abrasive particles 27, there is a supply line 55 for abrasive particles 27. Furthermore, the blasting chamber 65 has an outlet system 59. The outlet system 59 is fitted, for example, as a suction device. In this

15 way, substantially the entire quantity of the abrasively acting abrasive particles 27 can be recovered and reused for blasting. The abrasive particles 27 may in this case be produced from cast iron, steel, from synthetic corundum (aluminum oxide,

20  $Al_2O_3$ ), silicon carbide or silicate sand. In addition, abrasive particles 27 made from alloys or intermetallic compounds are possible. The particle source 5A, 5B and the component holder 49 together with the component 1 can move relative to one another. By way of example,

25 the particle source 5A, 5B can move in a plurality of axes with respect to the stationary component 1. Alternatively, the component 1 can move in a plurality of axes by means of the component holder 49, with respect to the particle source 5A, 5B. In particular,

30 the component holder 49 with the component 1 is arranged so that it can rotate about a vertical axis of rotation 67. This is highly advantageous in particular for the material-removing surface treatment of rotationally symmetrical components 1. For automated

35 surface treatment of the component 1, the blasting installation 47 is equipped with a control system 61. The particle source 5A, 5B and the component holder 49 are connected to the control system 61 via respective control signal lines 63A, 63B, 63C. In this way,

automated control of the movement of component 1 and particle source 5A, 5B is possible. In particular, the relevant jet parameters of the particle source 5A, 5B can be automatically controlled, so that to produce a preferably homogeneous component surface 3 in a blasting process, the blasting distance  $d$  and the blasting angle  $\alpha$  along a contour line 9A, 9B on the component surface 3 adopt a predeterminable, preferably constant value. Fitting the blasting installation 47 with a plurality of particle sources 5A, 5B allows simultaneous surface treatment of the component 1 along various contour lines 9A, 9B on the component surface 3.

15 In a method for the surface treatment of the component 1 in the automated blasting installation 47, the particle source 5A, 5B is supplied with abrasive particles 27 and with carrier medium 29, in particular compressed air 29, via the reservoirs 53, 57. Material 20 is removed from the component surface 3 along a contour line 9A, 9B on the component surface 3 by the particle jet 7A, 7B which is generated by means of the particle sources 5A, 5B and is characterized by the jet parameters blasting distance  $d$ , blasting angle  $\alpha$  and 25 blasting time. The blasting parameters are deliberately matched to the contour line 9A, 9B in such a way that a predetermined, preferably homogeneous surface roughness is established along the contour line 9A, 9B. In the process, the jet parameters are automatically adapted 30 by means of the control system 61, which controls the relative movement of the component 1 and of the particle sources 5A, 5B. The mode of operation in which the particle source 5A, 5B is moved relative to the component 1 in such a way that the blasting distance  $d$  35 and the blasting angle  $\alpha$  are constant is particularly favorable. The control system 61 is responsible for accurate positioning and controlling of component 1 and of the particle source 5A, 5B. This allows the surface treatment of components 1 with a complex geometry, in

particular with a curved component surface 3, with high quality and reproducibility. This is highly advantageous in particular for series production of components 1 and their surface treatment.

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The invention is distinguished by the fact that the component surface of a component which, in particular, has regions of different curvature is blasted with abrasive particles for the purpose of surface treatment of the component. This results in smoothing and/or cleaning with, if appropriate, activation of the component surface. The method is suitable for processing the base body of a component and for preliminary processing of a component which is to be coated. In particular, the method can be integrated in a method for producing a layer system on a base body of a component. The material-removing processing of the component surface is deliberately matched to the geometry of the component, resulting in a homogeneous surface treatment.

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